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POWER SUPPLIES UNLIMITED

P-30-1/1B

NJE CORPORATION Kenilworth, New Jersey

INSTRUCTION MANUAL

MODULE SUPPLIES

P30-1/1B

NJE CORPORATION
20 Boright Ave.
Kenilworth, N. J.

BRidge 2-6000

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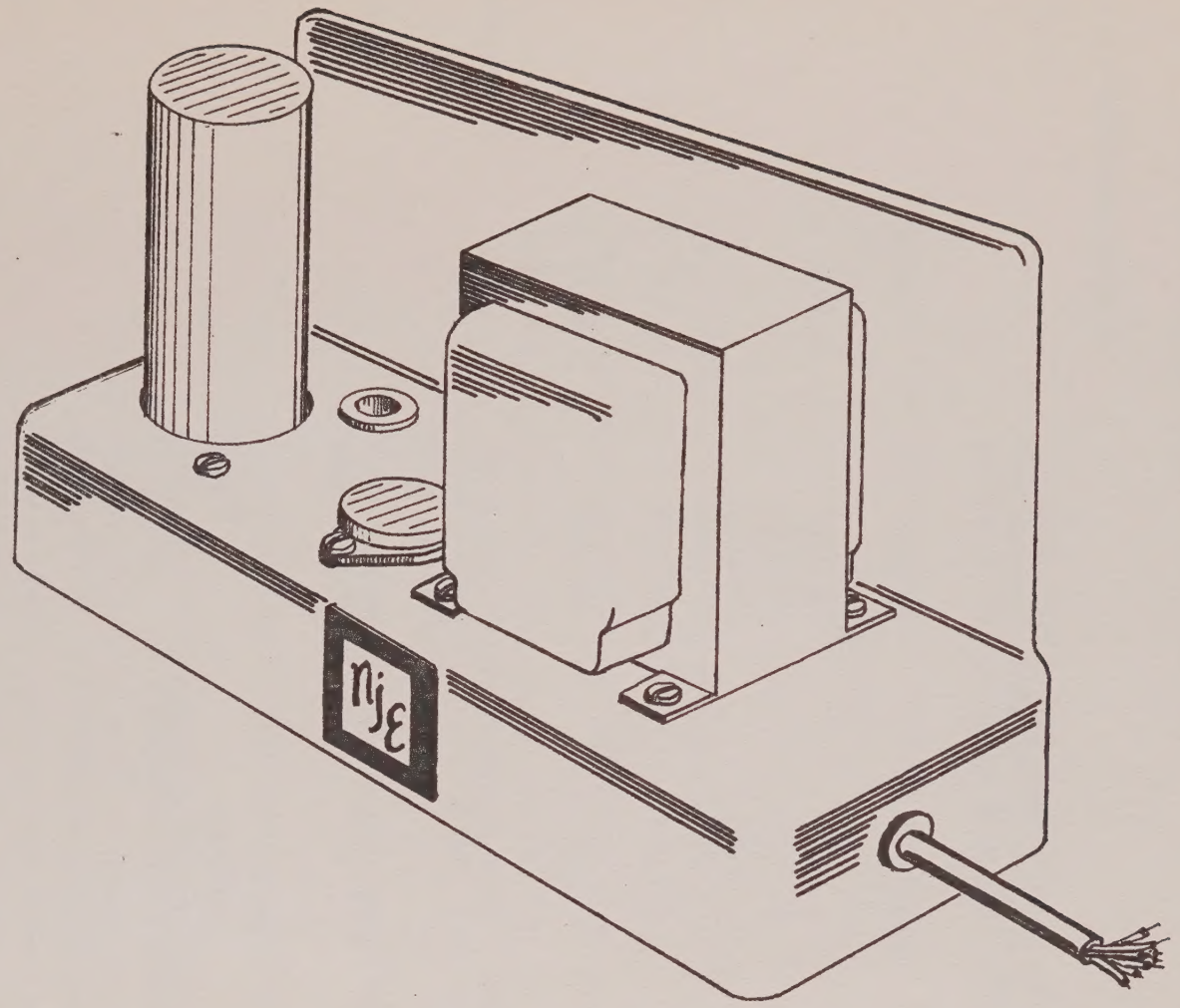
P30-1/1B



NJE CO.

MODULE SUPPLIES

DWG. No. 100341 | SZC

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SECTION I

SPECIFICATIONS AND DESCRIPTIONS

1-1. SPECIFICATIONS

Input: 115 volts RMS ± 10% single phase, 55-400 CPS. Continuously adjustable by a subchassis potentiometer over the range indicated below.

Model	Volts	Amperes
P-30-1B	12 to 20	0 to 1.0
	26 to 30	0 to 1.0
	10 to 33	0 to 0.75
P-56-0.5	36 to 56	0 to 0.5
P-72-0.5	56 to 72	0 to 0.5

Polarity: The output can be floated up to 500 volts peak above or below ground. Either polarity may be ground to chassis.

Ripple: Total hum and noise will not exceed value indicated in table below:

Model	Ripple
P-30-1B	5 millivolts peak to peak
P-56-0.5	5 millivolts peak to peak
P-72-0.5	2 millivolt peak to peak

Load Regulation: ± 0.05% for a zero to full load change.

Line Regulation: ± 0.05% for a 105 to 125 volt line.

Recovery Time: 50 microseconds.

Duty: Rated for continuous duty at ambient temperatures from 0° C to 35° C. Current rating must be reduced linearly to 0 at 75° C.

SPECIFICATIONS AND DESCRIPTIONS

1-K SERVICE MANUAL

Topics

Model		
P-30e-B		
P-40e-K		
P-75e-S		

Polarity

Ripple

Model	
P-30e-B	
P-40e-K	
P-75e-S	

Load Regulation

Line Regulation

Recovery Time

Duty

Rated for continuous duty at ambient temperatures from 0°C to 40°C. Derate 2% per °C above 40°C.

Temp. Coeff:

Model	T. C.
P-30-1B	0.03% /°C
P-56-0.5	0.015% /°C
P-72-0.5	0.15% /°C

Output Impedance: 10 CPS to 1 MC/S less than 3 ohms

Termination: 20" color-coded leads.

Series (Dualling) Operation: As many as 10 units may be connected in series to provide higher voltages.

Stability: Less than ±0.5% per day at laboratory conditions after a 30 minute warmup period.

Protection: AC Fuse
DC Fuse

Remote Sensing: Sensing terminals, separate from the output terminals, are provided in order that the unit may "sense", and regulate against, the voltage at the load rather than the voltage at the output terminals.

Remote Programming: This circuit has a sensitivity of about 25 ohms per volt. The output voltage may be adjusted by inserting an appropriate value resistance in series with the remote sensing leads. Provided the output variation is kept within the output range selected.

Mounting: Subchassis mounting by means of 4 screws.

SECTION II

PRINCIPLES OF OPERATION

2-1. General- A simplified diagram, illustrating the basic elements of the current, is shown in Figure 1. The AC line voltage is converted to a practical value by the power transformer and then is rectified by a bridge diode rectifier. A capacitor input filter smooths the pulsating DC output of the rectifier, providing a low-ripple, unregulated DC voltage to the input of the series regulator. The output voltage, furnished to the load by the series regulator, is continuously monitored by a differential amplifier. This amplifier can be considered to have four interdependent components, they are: The voltage to be compared, the reference voltage against which comparing is done, an adjustable means of changing the balance voltage, and lastly the difference voltage. The difference voltage is then properly transformed impedence-wise by the complimentary symmetry amplifier and series driver amplifier to control of the series regulator in such a way that it will counteract any change in the DC output voltage; thereby furnishing an essentially constant voltage to the external load.

2-2. Detailed Circuit Description - Circuit references in the following discussion applies to the schematic diagram at the back of the manual. This diagram shows the approximate electrical relationships, without regard to the actual physical location of the components, and is laid out in an arrangement approximately the same as that in the Block Diagram Figure I. The power supply is energized by connecting 115 volts (nominal) 60 cycles, single phase, to the input wires as follows:

Model	AC "Hot"	AC "Com"	
P-30-1B	White-gray	White-gray	Lo Range
	White-black	White-gray	Hi Range
P-56-0.5	White-black	White-gray	
P-72-0.5	Gray	White-gray	

The Power Transformer (T1) converts the 115V AC input line to an appropriate value on its secondary winding. This voltage is rectified by a Bridge rectifier (CR1 thru CR4), providing a pulsating DC output which is smoothed by the capacitor input filter (C2) and applied through a regulating transistor assembly to the output load.

Model		Series Pass Transistor
P-30-1B	Q6	(1) 2N375
P-56-0.5	Q6 &Q7	(2) 2N1362
P-72-0.5	Q6 &Q7	(2) 2N1362

The differential amplifier consists of a "balanced type" of amplifier to assure the minimum sensitivity to fluctuations of the ambient temperature or operating voltages. The input (comparing) signal for the amplifier is derived from a sensing voltage divider connected across the output of the supply.

This divider consists of resistors (R8 , R10, R13 and R17). The resistance setting of (R8) determines the operating value of the DC output voltage of the supply in a manner which will be further explained below. Potentiometer (R8) is the OUTPUT ADJUST control located on the printed circuit board and is a screwdriver adjustment. The diode (CR6) across the sensing lead protects the supply against reverse currents that could result from the external load when fuse (F2) is operated. In addition the diode provides a circulating path when supplies are series operated.

The negative end of the sensing voltage divider (junction R5 and R13) is returned to the positive sensing lead through zener diode (CR5). The diode (CR5) in conjunction with its load resistor (R5) provides a highly stable potential of a nominal 5.6 volts DC for use as a comparison voltage by the differential amplifier (Q4 and Q5). When the output of the power supply (measured at the load) is precisely at its selected nominal value, the voltage at the base of transistor (Q5) (derived from the sensing voltage divider) is at the same level as the base of transistor (Q4) and the input stage is in balance. Under this condition, any tendency of the load voltage to vary in either direction will unbalance the amplifier, resulting in corrective action which compensates for the impending change, and holds the load voltage at its established value.

Transistors (Q4 and Q5) are PNP type units operated in the common-emitter mode. Their outputs, taken across the load resistors (R5 and R7), are direct coupled to the transistor bases of succeeding stage (Q2 and Q3) which consist of one NPN and PNP transistors operated as a complimentary symmetry amplifier. The output of transistors (Q2, 3) at its load resistors (R1 & R2) is connected to the base of the driver transistor Q1. The zener diode (Models P-72-0.5 and P-56-0.5 only) provides a means of isolating the great voltage diff erence between the base of transistor (Q3) and the base of transistor (Q1) (which is effectively the collector of transistor Q3).

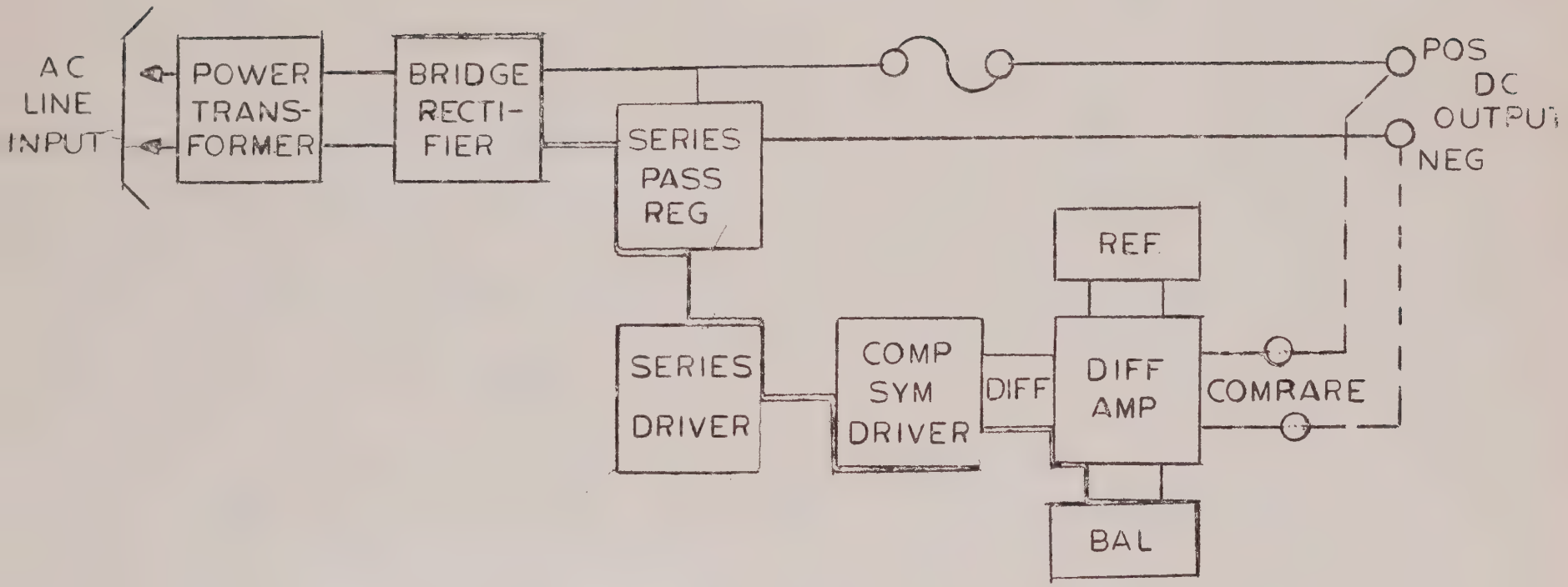
The changes in the driver transistor (Q1) causes the series pass transistor (Q6 for model P-30-1B), (Q6 and Q7 for model P-72-0.5, P-56-0.5)to increase or decrease its conductivity according to the difference voltage developed.

Capacitors (C2 and C6) provide a short circuit path for any AC voltage that may appear across the load resistors (R1 and R2). Capacitor (C3) suppresses oscillation that tend to occur at this stage of the circuit. Capacitor (C5) is used to increase the response time of the voltage sensing divider circuit.

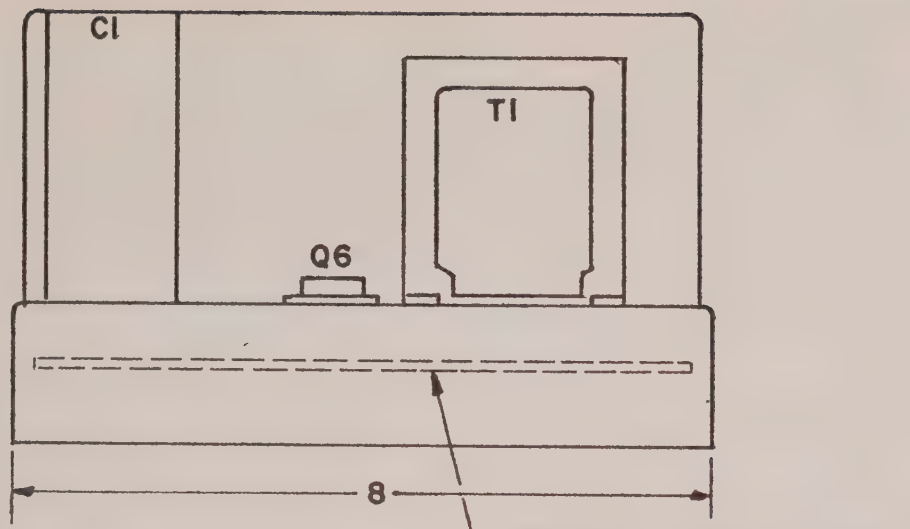
2.3 Corrective Action - The sequence of corrective action around the series-regulator feedback loop is as follows: The input to transistor (Q5) is the zero reference level--in this case, the voltage at the negative terminal of the load. The input to transistor (Q4) is the difference between the voltage across diode (CR5) (the reference voltage) and the voltage of the sensing voltage divider. When the DC load voltage is at the selected value, the voltage at the divider and the voltage across diode (CR5) are equal, so that the base of transistor (Q4) is at the same potential as the base of transistor (Q5) and the outputs of the two transistors are balanced. When the load voltage tends to deviate from the selected value in either direction, due to a change in the load current or in input line voltage, this will cause the voltage on the sensing divider to differ from the voltage across the reference diode (CR5) and the difference (or "error") voltage unbalances the amplifier stage (Q5) - (Q4). This difference appears in amplified form in the output of this stage, and is further amplified by the subsequent amplifier stages before being applied to the driver transistor (Q1). The output of the driver transistor causes the regulating transistors (Q6/or Q7) to increase or decrease its conductivity in accordance with the error signal so that its overall emitter collector voltage drop absorbs the impending variation in load voltage, maintaining an essentially constant value of voltage across the load terminals. Capacitor (C5) assists the amplifier in responding to rapid changes in load voltage by bypassing a portion of the sensing circuit. The more rapid the change, the greater is the initial transfer of voltage direct to the input of the amplifier, enabling it to anticipate any radical load variation before the excursion becomes significant.

The sensitivity and speed of response of the corrective feedback circuit is such that the above-described action occurs almost instantaneously, and the actual excursion of the load voltage is held to a very small value. The circuit is a true proportional regulator, and must allow a small but finite "error" to exist between the required and actual regulated voltage, so that this error, however small, can generate the correction signal. By proper circuit design, the error is held to a value which remains within the specified regulation allowance of the power supply.

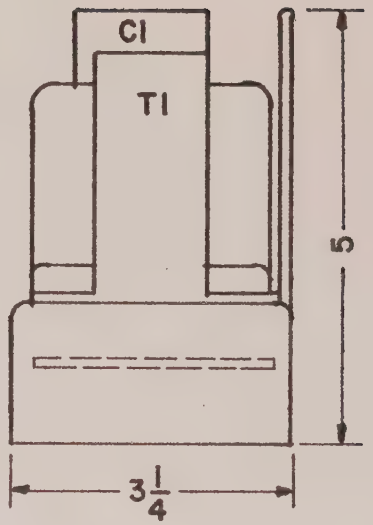
When potentiometer (R8) is readjusted to produce a different value of output voltage, the circuit makes a correction similar to that described above. Altering the resistance in the sensing voltage divider unbalances the input stage of the feedback amplifier, which then causes the circuit to produce a new value of voltage such that the drop across resistors (R10) again equals the drop across diode (CR5). Reducing the value of potentiometer (R8) for example, momentarily decreases the drop across (R10) (assuming a constant value of output voltage). However, this unbalanced condition at the amplifier input causes the DC output voltage to decrease until the drop across (R10) again equals the drop across (CR5) and the circuit stabilizes at this new operating point, establishing a lower value of DC output voltage.



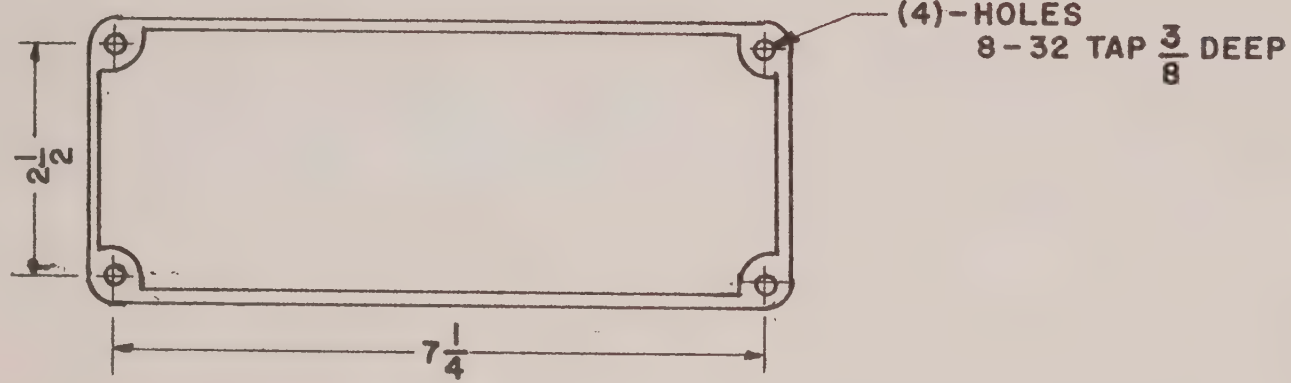
MODULE SUPPLY
BLOCK DIAGRAM
FIG. 1



FRONT



SIDE



BOTTOM

(MOUNTING DETAIL)

NJE CO.

MODULE SUPPLIES

DWG. NO. 100342	JZC

NJE CORP., KENILWORTH, N. J.

Spare Parts List

Model: P 30-1

Proj. App.

Std. App.

Ref. Des.	Description	NJE Part No.	Qty	**Rec. Spare	*Rec. Vendor
	SCHEMATIC	101322	x		23
	Printed Ckt. Ass'y	302239	1	1	23
C1	Cap, Fixed, Elect 900MF, 80V	5CE-80-900	1	1	17
C2	Cap, Fixed, Elect 100MF, 50V	3CE-50-100	1	1	17
C3	Cap, Fixed, Paper 0.02MF, 200V	1CP-200-0.02	1	1	17
C4	Cap, Fixed, Elect 50MF, 150V	3CE-150-50	1	1	17
C5	Cap, Fixed, Paper 1MF, 200V	2CP-200-1	1	1	17
C6	Cap, Fixed, Paper 0.1MF, 200V	1CP-200-0.1	1	1	17
CR1	Semicond. device diode	CER 68	5	1	29
CR2	Same As CR1				
CR3	Same As CR1				
CR4	Same As CR1				
CR5	Semicond. device diode	1N1983 ±5%	1	1	24
CR6	Same As CR1				

* Recommended vendors are listed at the end with serial cross references.

** Recommended spares are for one unit for one year service.

NJE CORP., KENILWORTH, N. J.

Spare Parts List

Model: P 30-1

Proj. App.
Std. App.

Ref. Des.	Description	NJE Part No.	Qty	** Rec. Spare	* Rec. Vendor
F1	Fuse, cartridge 1-1/4A SB	1FSB-125-1-1/4	2	5	6
F2	Same As F1				
Q1	Semicond. device transistor	2N1730	1	1	10
Q2	Semicond. device transistor	2N1304	1	1	16
Q3	Semicond. device transistor	2N1039	1	1	22
Q4	Semicond. device transistor	2N1415	2	1	16
Q5	Same As Q4				
Q6	Semicond. device transistor	2N375	1	1	22
R1	Res, Fixed, Comp 2700, 1/2W	1RFC-1/2-2700	5	1	1
R2	Same As R1				
R3	Not Used				
R4	Res, Fixed, Comp 1000, 2W	1RFC-2-1000	1	1	1

* Recommended vendors are listed at the end with serial cross references.

** Recommended spares are for one unit for one year service.

NJE CORP., KENILWORTH, N. J.

Spare Parts List

Model: P 30-1B

Proj. App.

Std. App.

Ref. Des.	Description	NJE Part No	Qty	** Rec. Spare	* Rec. Vendor
R5	Res, Fixed, WW 470, 3W	2RFW-3-470	1	1	33
R6	Same As R1				
R7	Same As R1				
R8	Res, Var, WW 750, 2W	1RVW-2-750-SL	1	1	9
R9	Same As R1				
R10	Res, Fixed, WW 150, 3W, 3%	4RFW-3-150	1	1	12
R11	Res, Fixed, Comp 150, 1/2W	1RFC-1/2-150	1	1	1
R12	Res, Fixed, WW 1.0, 3W	2RFW-3-1	1	1	12
R13	Not Used				
R14	Res, Fixed, Comp 470, 1/2W	1RFC-1/2-470	1	1	1
R15	Not Used				
R16	Not Used				
R17	Res, Fixed, WW 100, 3W, 3%	4RFW-3-100	1	1	12

* Recommended vendors are listed at the end withserial cross references.

** Recommended spares are for one unit for one year service.

NJE CORP., KENILWORTH, N. J.

Spare Parts List

Model: P 30-1

Proj. App.

Std. App.

Ref. Des.	Description	NJE Part No	Qty	** Rec. Spare	* Rec. Vendor
T1	Transformer	1TF-1	1	1	37
XQ1	Sockets, transistor	2XQ-MC	1	-	38
XQ2	Sockets, transistor	1XQ-MC	4	-	14
XQ3	Same As XQ2				
XQ4	Same As XQ2				
XQ5	Same As XQ2				
XQ6	Sockets, transistor	3XQ-MC	1	-	8

* Recommended vendors are listed at the end with serial cross references.

** Recommended spares are for one unit for one year service.

List of Code Numbers used in

Spare Parts List

To Indicate Manufacturer

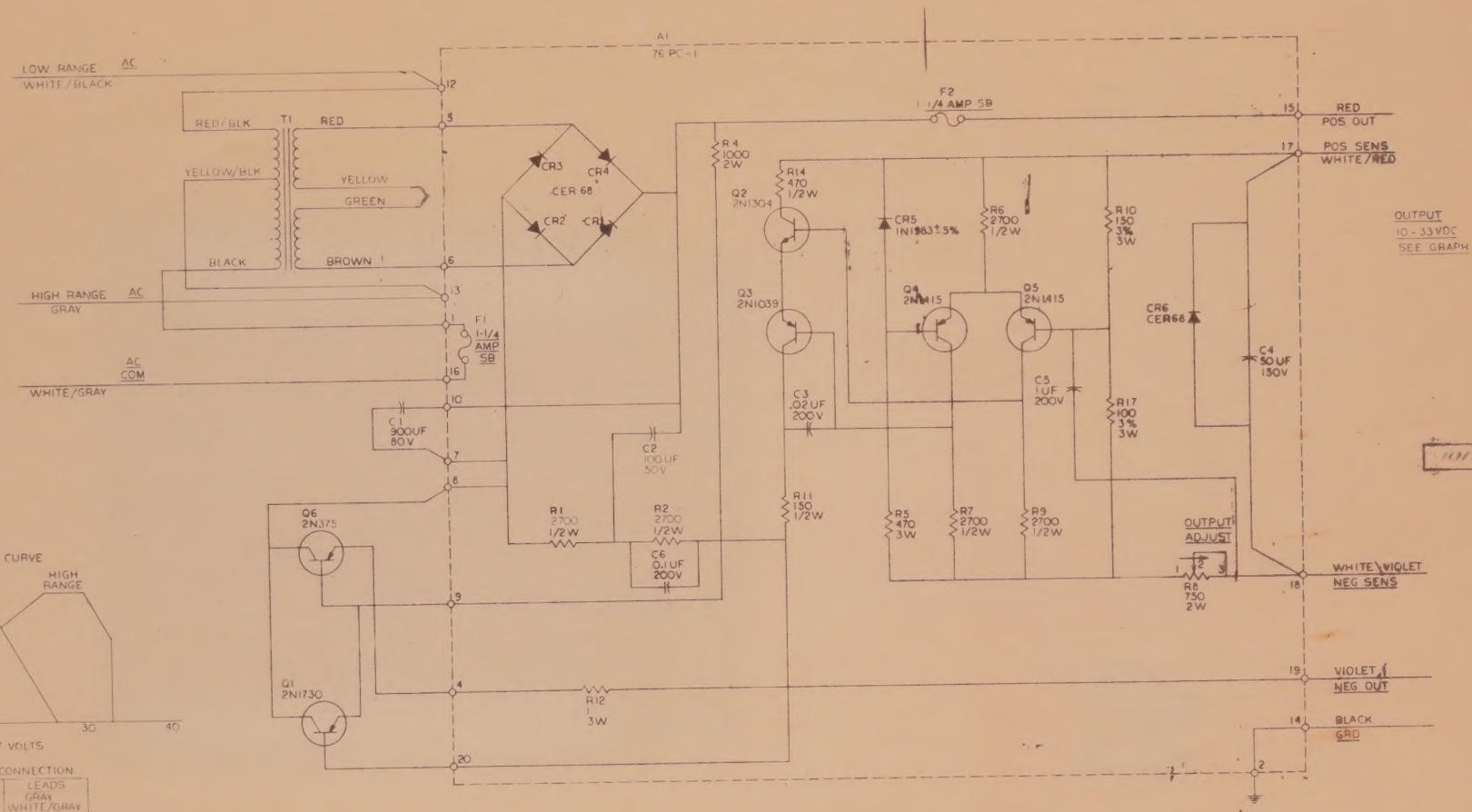
Code Number	Manufacturer	Location
1	Allen-Bradley Co.	Milwaukee, Wisconsin
2	Astron	East Newark, N. J.
3	Barber Colman Co.	Rockford, Illinois
4	Helipot (Div. of Beckman Inst.)	Fullerton, Calif.
5	Bourns Inc.	Riverside, Calif.
6	Bussmann (Div. of McGraw-Edison)	St. Louis, Mo.
7	Centralab Elec. (Div. Globe-Union)	Milwaukee, Wisc.
8	Cinch Mfg. Co. (H.B. Jones Div.)	Chicago, Ill.
9	Clarostat Mfg. Co.	Dover, New Hampshire
10	Clevite Transistor	Waltham, Mass.
11	Columbus Electronics	Yonkers, N. Y.
12	Dale Electronics (Sub. of Hathaway Ins. Inc.)	Columbus, Nebraska
13	Dialight Corp.	Brooklyn, N. Y.
14	Elco Manufacturing	Philadelphia, Pa.
15	Fansteel	No. Chicago, Ill.
16	General Electric	Syracuse, N. Y.
17	General Instrument	Newark, N. J.
18	General Transistor	Los Angeles, Calif
19	Herman H. Smith	Brooklyn 10, N. Y.
20	Hoffman	El Monte, Calif.
21	Little Fuse Inc.	Des Plaines, Ill.
22	Motorola	Phoenix, Ariz.
23	NJE Corporation	20 Boright Avenue, Kenilworth, N. J.
24	North Amer. Elec. (Affiliate of I.R.C.)	West Lynn, Mass.

(List of Code Numbers used in Spare Parts List To Indicate Manufacturer cont'd)

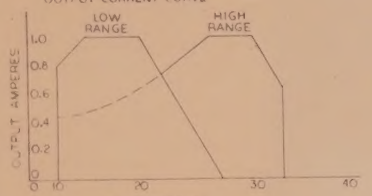
Code Number	Manufacturer	Location
25	Ohmite	Skokie, Ill.
26	Philco	Lansdale, Pa.
27	Pyramid Elec. Co. (Div. of Gen. Inst.)	Darlington, S. C.
28	Rotron	Woodstock, N. Y.
29	Solitron	Norwood, N. J.
30	Spectrol	San Gabriel, Calif.
31	Sprague	North Adams, Mass.
32	Superior Electric Co.	Bristol, Conn.
33	Tru-Ohm (Model Eng.)	Chicago, Ill.
34	U. S. Semcor	Phoenix, Arizona
35	Westinghouse	Youngwood, Pa.
36	Standard Electric Co.	Dayton, Ohio
37	Stancor Electronics, Inc.	Chicago, Ill.
38	Jettron Products	Hanover, N. J.
39	Dickson Electronics Corp.	Scottsdale, Ariz.
40	Aerovox Corp.	New Bedford, Mass.
41	Radio Switch	Marlboro, N. J.
42	Radio Corp. of Amer. (Elec. Tube. Div.)	Harrison, N. J.
43	Cornell Dublier (Div. of Fed. Pacific Elec.)	Newark, N. J.
44	Chicago Cond. Corp.	Chicago, Ill.
45	Arco Electronics	Great Neck, N. Y.
46	International Resistance Co.	Philadelphia, Pa.
47	Amperex Electronics Corp.	Hicksville, N. Y.
48	Resistor Products Co.	Harrisburg, Pa.
49	Syntron Co.	Homer City, Pa.
50	Amphenol Connector (Div. of Amphenol-Borg)	Chicago, Ill.
51	Continental-Wirt.	Philadelphia, Pa.
52	Royal Electric Corp.	Pawtucket, R. I.

[illegible]	Manufacturer	[illegible]
3	National Resistance Co.	Paterson, N. J.
[illegible]	Radio Switch Corp. (formerly Communication Products Co., Inc.)	Marlboro, N. J.
[illegible]	G. V. Control, Inc.	Livingston, N. J.
[illegible]	Shaevitz Engineering	Pennsauken, N. J.
[illegible]	Howard Industries	Cassville, Mo.
[illegible]	Stevens Mfg.	Mansfield, Ohio
[illegible]	Vernitron Products Co.	[illegible] Glen Lakes, N. Y.
[illegible]	Delco Radio, (Div. General Motors Corp.)	Kokomo, Indiana
[illegible]	Rogers Products, Inc.	Rolla, Mo.
[illegible]	Sutton Rare Metals Co.	[illegible]
[illegible]	Potter Corp.	[illegible] Park, Col.
[illegible]	Cambridge Thermionic Corp.	Cambridge 38, Mass.
[illegible]	U. S. Engineering Co. Div. of Litton Industries	Mount Vernon, N. Y.
[illegible]	August Bros. Inc.	Attleboro, Mass.
[illegible]	Bourns, Inc.	Riverside, Calif.
[illegible]	Chicago Standard Transf. Co.	Chicago, Ill.
[illegible]	Cutler-Hammer Inc.	Milwaukee, Wisc.
[illegible]	Allied Control Co., Inc.	New York 21, New York
[illegible]	The Rowan Controller Co.	Baltimore, Md.
[illegible]	Kurman Electric Co. Sub. Litton Industries	Brooklyn, N. Y.
[illegible]	Arco Electronics, Inc. Elemenco	New York, N. Y.
[illegible]	Texas Instrument, Inc.	Dallas, Texas

REVISIONS			
BTR	DESCRIPTION	DATE	APPROVED
A	ECO 3674	8-12-64	
B	ECO 4334	8-24-64	



OUTPUT CURRENT CURVE



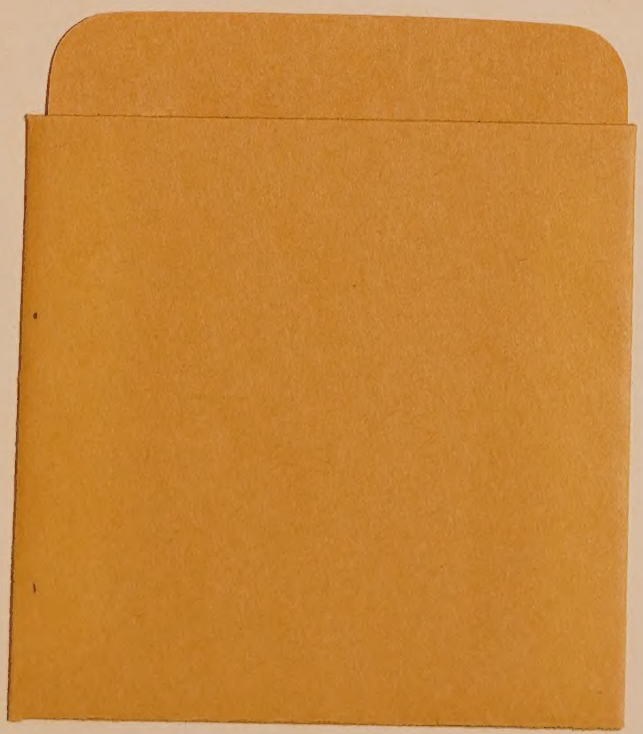
AC INPUT CONNECTION

RANGE	LEADS
HIGH	GRAY
	WHITE/GRAY
LOW	WHITE/BLACK
	WHITE/GRAY

NOTES:
1. THIS UNIT IS EQUIPPED WITH SEPARATE OUTPUT SENSING TERMINALS. THESE SENSING TERMINALS MUST BE CONNECTED DIRECTLY TO THE LOAD TERMINALS (OBSERVING POLARITY) BY MEANS OF LEADS PROVIDED. DO NOT OPERATE SUPPLY WITH SENSING LEADS UNCONNECTED.

UNLESS OTHERWISE SPECIFIED	DRAFTSMAN J. Salemi	DATE 9.14.61	TITLE MODEL P30-1B SCHEMATIC DIAGRAM
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES	DESIGNER		NJE CORPORATION KENILWORTH, N.J.
MATERIAL	CHECKER		SIZE D
PROTECTIVE FINISH	ENGINEER E. Wrack APPROVED	9-14-61	101322
NEXT ASSY USED ON APPLICATION	DO NOT SCALE DWG	SCALE	WT

101322



MANUFACTURERS REPRESENTATIVES

Albuquerque, New Mex.

Barnhill Associates
319A Wyoming N.E., Albuquerque, New Mex.
265-7766

Boston, Mass.

Burlingame Associates, Ltd.
7 Wellington Street, Waltham, Mass.
TWinbrook 4-1955

Chicago, Ill.

Ridgway Associates
6100 W. North Ave., Chicago 39, Ill.
TUxedo 9-5715

Cleveland, Ohio

Ridgway Associates
5915 Schaaf Rd., Cleveland 31, Ohio
LAfayette 4-1421

Dallas, Texas

Carey-Wolf Co.
P.O. Box 12425, Ft. Worth, Tex.
TA 3-5383

Dayton, Ohio

Ridgway Associates
3898 Linden Ave., Dayton 29, Ohio
CLearwater 2-5604

Denver, Colo.

Barnhill Associates
1170 South Sheridan Blvd., Denver, Colorado
WEst 5-4645

Detroit, Mich.

Ridgway Associates
3384 Twelve Mile Rd., Berkley, Michigan
LIncoln 6-3312

Ft. Worth, Texas

Carey-Wolf Co.
P.O. Box 12425, Ft. Worth, Tex.
PE 8-1702

Houston, Texas

Carey-Wolf Co.
P.O. Box 14426, Houston, Tex.

Indianapolis, Ind.

Ridgway Associates
1224 N. Capitol Ave., Indianapolis 2, Indiana
MElrose 5-2401

Kansas City, Mo.

Lee Mark Associates
4021 W. 86th St., Prairie Village, Kansas
NIagara 2-3313

Los Angeles, Calif.

G. S. Marshall Company
2065 Huntington Drive, San Marino, Calif.
MUrray 1-3292

Montreal, Canada

Radionics, Ltd.
8230 Mayrand St., Montreal, Canada
REgent 9-5517

New York City Area

Burlingame Associates, Ltd.
510 South Fulton Ave., Mt. Vernon, N. Y.
MOunt Vernon 4-7530

Ontario, Canada

Radionics, Ltd.
4938 Yonge St., Willowdale, Ontario
222-3261

Philadelphia, Pa.

Burlingame Associates, Ltd.
222 Long Lane, Upper Darby, Pa.
JAckson 8-6080

Phoenix, Arizona

G. S. Marshall Company
30 Pima Plaza, Scottsdale, Ariz.
WHitney 6-5521

St. Louis, Mo.

Lee Mark Associates
2001 Big Bend Blvd., St. Louis 17, Mo.
MIssion 7-1470

Salt Lake City, Utah

Barnhill Associates
300 So. Main, Centerville, Utah
AXtel 5-6521

San Diego, Calif.

G. S. Marshall Company
4410 Kearny Mesa Rd., San Diego, Calif.
BR 8-6350

San Francisco, Calif.

G. S. Marshall Company
801 Woodside Rd., Redwood City, Calif.
EMerson 6-8214

Seattle, Washington

Burt C. Porter Company
1209 Poplar Place, Seattle 44, Washington
EAst 3-8330

Syracuse, N. Y.

Burlingame Associates, Ltd.
514 University Bldg., Syracuse, N. Y.
GRanite 4-7409

Washington, D.C.

Burlingame Associates, Ltd.
8218 Wisconsin Ave., N.W., Washington 14, D.C.
OLiver 4-6400

Winston-Salem, N.C.

M. J. McDonald Co.
Whippoorwill Drive, Rt. 1, Pfafftown, N. C.
WAbash 4-2182

OUR WARRANTY: N J E Corp. warrants each power supply manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replacing any defective parts thereof, except tubes, semi-conductors and fuses. This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started. Written permission must be obtained from the factory, before a supply may be returned for examination.

NJE CORPORATION
Electronic Development & Manufacturing
Kenilworth, New Jersey • BRidge 2-6000
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